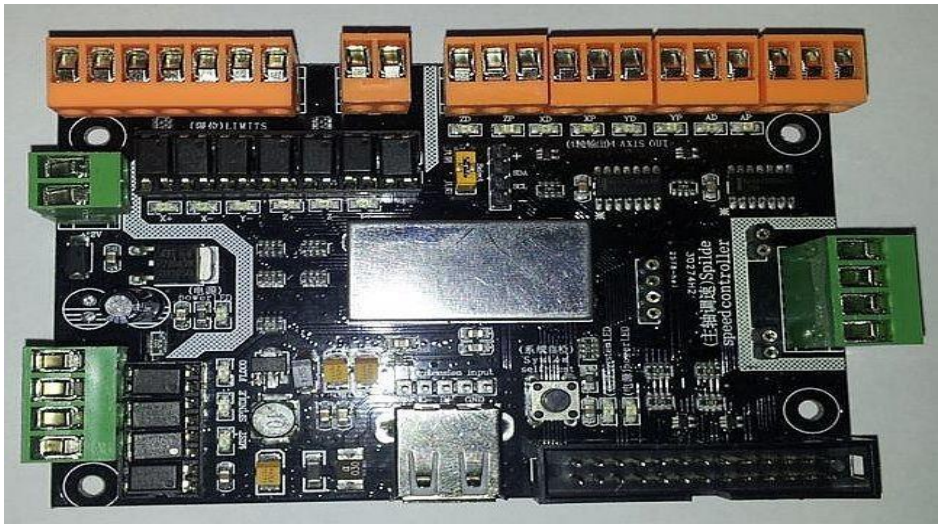
4 AXIS CNC USB Controller Mk1

By Pennybuying --------http://www.pennybuying.com

(English manual)



4 Axis CNC USB Controller - Mk1

PLEASE NOTE

The Author of this manual is in no way affiliated with either SKY Studio (http://www.pennybuying.com) or USB CNC (Planet-CNC.com)

This manual is provided as a courtesy to non-Chinese speaking CNC enthusiasts who wish to use this board as an alternative to the ones supplied by Planet-CNC. There is talk of “Counterfeit boards” however I do not believe this is one. It is based on the open source USBCNC Mk1 board but with many enhancements by Sky Studio. Please be sure to get a genuine license key from www.Planet-CNC.com to active the USBCNC program.

Enjoy...

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CNC USB Software

SKY's CNC USB Mk1 Controller is designed to be compatible with Planet-CNC's USBCNC Controller software.

System Requirements

USB CNC specify the following requirements:

Minimum system requirements:

- 1.6 GHz or faster processor
- 1024 MB RAM
- 500 MB available hard disk space
- DirectX 9 graphics device with WDDM 1.0 or higher driver
- USB 2.0 port
- .NET Framework 3.5 SP1

Features:

The Standard Board features:

- 25 kHz maximum step frequency
- 3 digital outputs (flood, mist, spindle)
- 12 us minimum pulse width
- manual jog input keys for all axes
- limit keys for all axes
- control external devices with I2C protocol
- USB (V2.x) from PC/Laptop running Windows XP, Vista or Windows 7 (32 bit or 64bit)
- motor driver connector pin-out is compatible with 10 pin open source interface
- controller works with most step/dir motor drivers available on the market
- buffered I/O for maximum performance
- advanced interpolation algorithms
- start, stop, pause and resume execution of program on your machine
- standard RS274/NGC G-code (EMC2 compatible)
- advanced G-codes - G40, G41, G42 (Cutter Radius Compensation) supported
- advanced G-codes - G43, G49 (Tool Length Offsets) supported
- advanced G-codes - G54, G59.3 (Coordinate System Origins) supported
- tested with SolidCAM, MasterCAM, ArtCAM, Vectric, ... generated G-code
- Profili 4-axes and 3-axes G-code supported
- import tool path from:
    - DXF files
    - PLT/HPGL files
    - image files
    - NC-Drill (Excellon) files

    - Gerber (RS-274X) files
- tool path simulation
- automatic homing procedure
- automatic tool length measuring
- advanced tool change procedures
- export tool path to:
    - G-code
    - DXF
- a SDK (software developers kit) is available

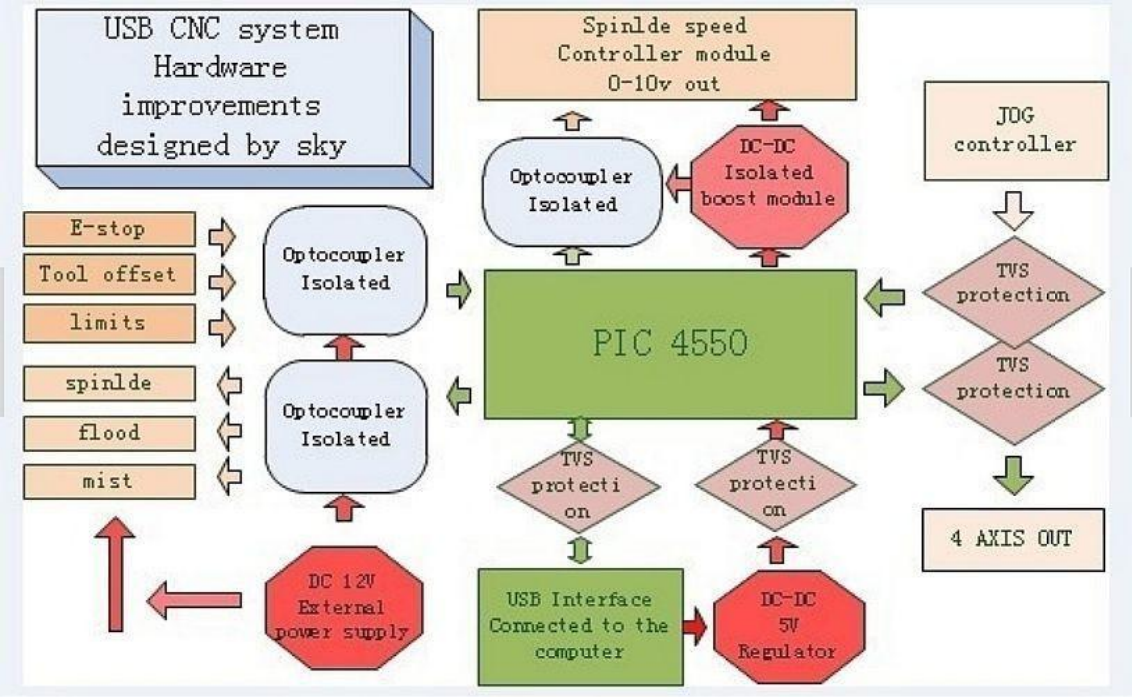
The Controller

DISCLAIMER: Here's the fine print... This controller is manufactured in China and has several blocks of Chinese text screen printed on it. I don't profess to know any Chinese at all so some descriptions are based on electronic knowledge & measurements. They are correct to the best of my knowledge but some errors and omissions are possible.

SKY Studio enhancements

Based on the Open-source USBCNC Mk1 Hardware design, SKY Studio have made significant improvements over the original design. The controller is extremely stable even in noisy environments – part of the testing phase included a 1cm spark gap within 10cm of the board. Even the use of an arc-welder within ½ a metre didn't stop the unit from working!

Block Diagram of controller



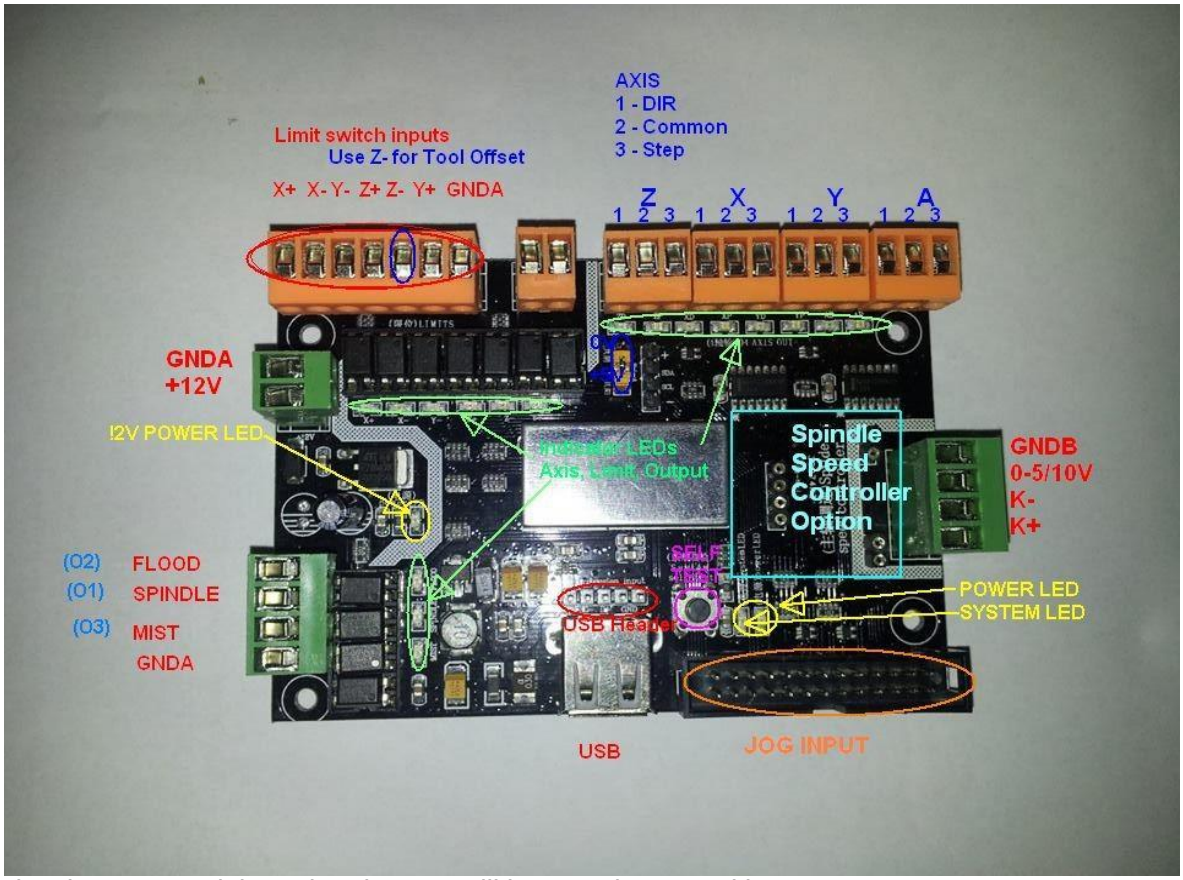
As you can see there are many enhancements to the Controller board that have been added by SKY Studio:

- Opto-couplers on the inputs
- Opto-couplers on the relay outputs
- Separate power supply for the I/O points
- DC-DC regulator for the PIC4550 improves noise immunity
- Extensive use of TVS (Transient Voltage Suppression) protection to protect the circuitry
- Fully isolated 0-5/10v Spindle speed controller(optional)

It must be noted that the Spindle speed controller module 0-5/10v out is NOT included with the basic board, it is an optional extra. It also uses two of the output pins (1 & 3) so don't think you will gain 3 relay outputs when you install that module.

4 AXIS Mk1 MOTOR connector

While the majority of the pin uses are silk-screened onto the circuit board and can be read from the underside, most people will have the board mounted into a case before making the connections – which obviously means they won't be readable at the time.



Okay let's get straight to the pins you will be most interested in...

The 4 Axis connectors

The 4 Axis connector blocks each contain 3 pins used as follows:

Pin 1 – Provides the DIR, or DIRECTION signal to the motor driver

Pin 2 – Provides a Common Anode, or Cathode (Based on Yellow Jumper position)

Pin 3 – Provides the CLK, STEP, or PULSE signal with minimum 12us pulse width to the motor driver

This revision board has a Yellow Jumper (Labelled “Select”) near the Z axis connector beside the I2C port – Short Pins 2-3 for +5v (common Anode), Short Pins 1-2 for 0v (common Cathode)

If your revision board does not have this jumper it will be common anode only.

LIMIT switch connector

Six Limit Inputs are provided. These inputs are opto-isolated. Power for these inputs is provided from the separate 12v input to the board.

- LIMIT 1-6 connects to the limit switches. From 1 to 6 they are: X+, X-, Y-, Z+, (Z-), Y+. It's recommended that a 100nF capacitor is connected directly across the switch terminals to increase noise immunity.
- Pin 5 (Z-) can be used for tool length measurement.
- Pin 7 (GNDA) is 'Ground' or common for all Limit switch connections.

The Limits can be configured for one of two possible configurations. The preferred configuration will determine limit switch connections.

- NORMAL: Each switch is connected to its own pin with positive and negative limits determined by designated switches.
- SINGLE INPUT: Both axis limit switches are connected to one pin. Direction of travel determines if positive or negative switch is triggered.

E-Stop Connector

The E-Stop Input connector is located between the LIMITS connector and Z Axis Connector. Like the LIMIT connectors it too is opto-isolated.

For safety you should have the E-Stop circuit as Normally Closed. That way if a fault in the wiring develops, it will trigger the E-stop alerting you to this fact.

Output relay connector

Three outputs are provided. These outputs are opto-isolated and can only drive solid state relays. Labelled on the board as:

- Pin 1: Flood – Output #2 (can be reassigned in USBCNC Software settings)
- Pin 2: Spindle – Output #1 (can be reassigned in USBCNC Software settings)
- Pin 3: Mist – Output #3 (can be reassigned in USBCNC Software settings)
- Pin 4: GNDA – 'Ground'

12v Power Input connector

This connector is used to provide power for the optically isolated section of the board. If you don't want to use the Limit switches or E-Stop this power input can be ignored.

- Pin 1: 12v in
- Pin 2: GNDA

The 12v input is regulated down to 9v.

An LED is provided on the board to indicate that the 9v power is active.

Some information is available that suggests the 12v input can be between 12-24v however as 24v is specified as the MAX VCC of the regulator I.C. It's safer to keep it around the 12v range.

All Pins marked as GNDA are common for this section of the board. They are isolated from the

rest of the board.

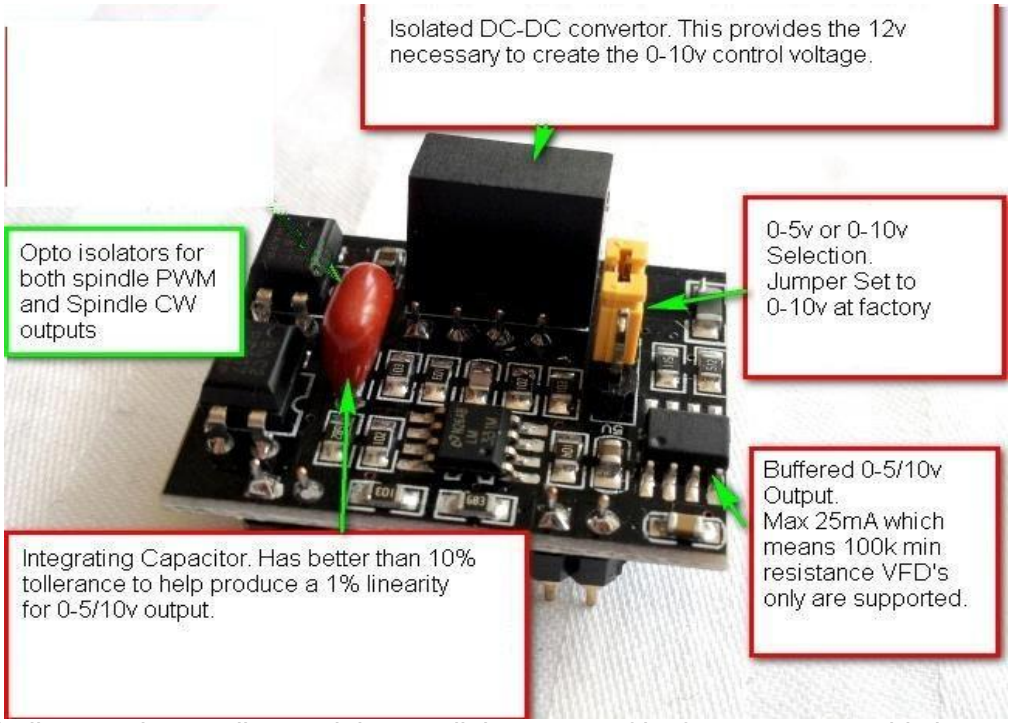
Spindle Speed Controller Connections

Note: These Connections are NOT used unless the board is fitted with the Add- on Spindle speed controller module. (It plugs in between the Metal shielded processor and the connector itself)

All Connections on the Spindle Speed controller are optically isolated from the rest of the board. The pins are as follows:

- Pin 1: GNDB – 'Analogue ground' for the spindle speed control voltage output.
- Pin 2: 0-5/10v – spindle speed control voltage output. Either 0-5v or 0-10v selectable by jumper on the module board.
- Pin 3: K- - Cathode output of opto-coupler for spindle on/off
- Pin 4: K+ - anode output of opto-coupler for spindle on/off

The Spindle Speed controller module contains an isolated DC-DC convertor to provide the voltage for the 0-5/10v output. This enables a true full scale swing for the control voltage; this is not possible when using the original output analogue voltage from the VFD unit itself.


Isolated DC-DC convertor. This provides the 12v necessary to create the 0-10v control voltage.
Opto isolators for both spindle PWM and Spindle CW outputs
0-5v or 0-10v Selection. Jumper Set to 0-10v at factory
Buffered 0-5/10v Output. Max 25mA which means 100k min resistance VFD's only are supported.
Integrating Capacitor. Has better than 10% tollerance to help produce a 1% linearity for 0-5/10v output.

The Spindle speed controller module – outlining some of its features. Note: this is an optional component that is not supplied with the basic board.

The connection to the VFD analogue input should have a 100nf capacitor across the VFD terminals and the wire should pass through a RF ferrite ring no less than 5 loops to ensure adequate RF isolation.

The 0-5/10v output is only suited to drive VFD units with 100k impedance and is only capable of supplying 25mA max current.

Jog input port connector

It appears that there are several versions of this board. The one pictured in this manual has a 26 pin connector, however I've only been able to track down the pin out for the 14 pin connector.

The remaining pins are “reserved for future use” according to the information I have received.

View from Top side of the board

Note that the Pin 1- Square Pin, is the Pin 1 of a 14 pin connector. It is actually the 7th pin on a 26 pin connector.

As you can see, there is some more Chinese writing on this picture which I do not understand, so my descriptions may differ a little from the original.

Assuming a 14 pin connector (for 26 pin number in brackets) the pins are used as follows:

- Pin 1(7) : X- - Jog X axis -
- Pin 2(8) : X+ - Jog X axis +
- Pin 3(9) : Y- - Jog Y axis -
- Pin 4(10) : Y+ - Jog Y axis +
- Pin 5(11) : Z- -Jog Z axis -
- Pin 6(12) : Z+ - Jog Z axis +
- Pin 7(13) : A- -Jog A axis -
- Pin 8(14) : A+ - Jog A axis +
- Pin 9(15) : GND – 'Ground' pin
- Pin 10(16): 5v – Power
- Pin 11(17): RST – Reset/Test board (common to on board reset/test button)
- Pin 12(18): F – Jog Speed feedback from Pot (10-30K ohm wiper pin. 0-5v)
- Pin 13(19): S – System LED
- Pin 14(20): P – Power LED

Pins 1-6, and 21-26 on the 26 pin connector are reserved for future use and may already be connected on the board. Don't connect them externally.

The Jog pins are active when pulled high 5v (best to do this via 1k resistor to limit current)

Reset/Test pin pull to Ground to reset

Power and System LED is to 5v (best via a1k resistor)

Software Installation

Download and install both the CNCUSB program and USB driver from Planet-

CNC.com. Install as per the instructions you got with that download.

Its pretty much Click, Yes, Next, Next, OK. To install.

One point of note though: do NOT plug the USB CNC controller board in until after you have installed the USB driver or you may have difficulties later.

To remove the 25 command limit on sending codes to the controller be sure to obtain a licence for the board. This license will remain valid for the controller board and can be migrated between PC's as long as they only talk to the board the license is for.

Enjoy your new board it will serve you well.